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Root Competition Slows Growth Of Plantings On Unprepared Sites In Scrub Oak

Planting experiments during the past 7 years on the Dilldown Unit of the Delaware-Lehigh Experimental Forest in Pennsylvania and elsewhere in the scrub oak type have been aimed at finding methods for converting the scrub cover to more valuable timber types at least cost. Some sort of site preparation has been recognized from the beginning as essential to successful planting on much of the scrub oak land.

Mechanically cleared strips 4 feet or more wide are effective but costly. Most tree seedlings planted in such strips will get through without benefit of additional release treatment. Killing the brush overall or in strips by use of silvicides with ground equipment is even more costly and poses planting difficulties.*

In the more open stands of scrub oak, another possibility was considered: interplanting skeleton stands of 200 to 400 trees per acre without site preparation. A seedling in an opening of width equal to or greater than the height of the brush might be expected to come through without help. Such interplantings were made in 1950 for $12 per acre.

Survival in this interplanting was satisfactory, but by the fourth and fifth years it was becoming increasingly apparent that the seedlings were not growing as well as where the sites had been prepared. Root competition, particularly from the dense low ground cover of blueberry and sheep laurel, was suspected as the cause of the slower growth. To ascertain the reality and magnitude of these

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*See McQuilkin, W. E. Weed killers of limited use in reforesting scrub oak barrens. U.S. Forest Serv., Northeast. Forest Expt. Sta. Forest Res. Note 6. 4 pp. 1951.

differences associated with site preparation, a small study was made during the winter of 1954-55.

Procedure

Available for comparison were red, jack, and pitch pines planted at Dilldown in 1950 from the same lots of planting stock under the following conditions:

1. In bulldozed furrows about 4 feet wide.
2. In strips 4 to 5 feet wide which had been treated with ammate in 1949. This killed most of the low blueberry-sheep laurel ground cover, killed the tops of the scrub oak, and retarded development of new basal sprouts for 2 years.
3. In openings between scrub oak clumps, with no site preparation.

Heights were measured in random samples of 100 trees of each species in the furrow plantings and interplantings. In the ammate-treated strips (a small test originally), there were not 100 survivors of each species. The samples here included these numbers of trees: red pine 80, jack pine 52, and pitch pine 100.

Results

Mean heights and their standard deviations were computed, and the differences in height between ground treatments were tested for significance for each species separately by conventional t-test. Heights and standard deviations are shown in the following tabulation.

Treatment	Red pine	Jack pine	Pitch pine
Furrowing	2.06±0.61	5.57±1.12	4.21±1.12
Ammate	1.79±0.51	5.65±1.42	3.76±0.80
None (interplanting)	1.40±0.50	3.35±1.00	2.41±0.53

With one exception--furrowing vs. ammate for jack pine--the trees in the furrows average taller than in ammated strips, and trees in both furrows and ammated strips average taller than in the interplantings with no site preparation. All these differences within species are significant by the t-test at the 1-percent level; that is, the

chances are 99 out of 100 that the differences are real treatment effects and not random variation.

Taking the heights in furrows as a base, height growth in the interplantings averages 32, 40, and 43 percent less for red, jack, and pitch pines respectively. Moreover, height does not tell the whole story. The trees in the furrows have heavier branches and more foliage, and are generally in better vigor.

Discussion

Since the trees in these samples were not suffering top competition other than some crowding from the sides, the height data support the theory that root competition is exerting an important influence upon growth. Best growth in the furrows (all root competition removed), slowest growth in the interplantings (no reduction of competition), and intermediate growth in the ammated strips (competition partly eliminated) are exactly what might be expected if root competition were the critical factor.

Whether or not the retarded seedlings in the interplantings will eventually gain the ascendancy and acquire normal vigor is not yet known. At present it appears doubtful that many trees will. Therefore extensive interplantings without some reduction in the existing root competition cannot now be recommended. A small interplanting experiment involving treatment of the individual planting spots with silvicide has recently been begun at Dilldown. This may point up a way of coping with the root-competition problem.

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